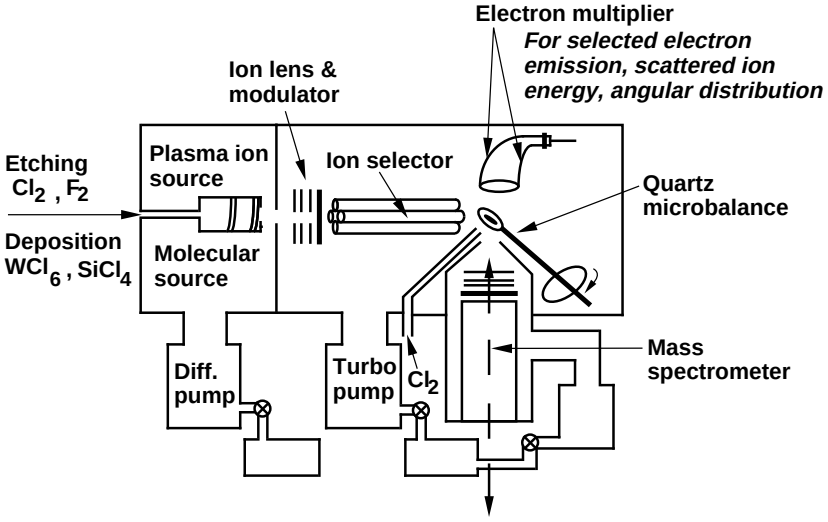
Molecular/Ion-Beam Spectroscopy

Identifies and measures key surface parameters to model 3-D circuit designs for advanced semiconductor devices

The next semiconductor generation—will a new processing technology be needed?

Processing technology will need to handle new semiconductor devices with features as small as 50 nm and aspect ratios greater than 10 to 1. Manufacturing these three-dimensional circuit designs will require in-depth knowledge of the elementary physical and chemical steps involved and precise control of processes that use various materials and components simultaneously.



System determines reactive sticking probability for plasma ion and product species as a function of incident energy and angle.

Plasma-assisted processing is the dominant dry technique now used to pattern thin films because it can etch and deposit anisotropically (different values in different directions) with high throughput at relatively low temperatures. However, the modeling codes that predict etch profiles for this type of processing rely on global parameters of plasma-surface interactions. Existing codes are useful primarily for a particular system configuration, substrate, and reactant(s). If plasma processing technology is to be used for future devices, it is necessary to measure the plasma-surface interactions and develop appropriate modeling codes.

APPLICATIONS

- *Semiconductor processing*
- *Micromachines and actuators*
- *Corrosion and erosion of materials*

Existing technology can do the job

We developed a unique molecular/ion-beam system that can identify and measure the following key parameters of plasma-surface interactions:

- Reaction rate (as a function of selected neutral or ion energy and angle)
- Reaction product (as a function of product angular and velocity distribution)
- Surface elementary steps in the overall reaction (as a function of the energetic regime).

This unique system allows users to:

- Direct selected ion beams to the surface with energies of 10 to 5,000 eV and neutrals with thermal or supersonic velocity
- Vary the ion incident angle
- Measure the etch rate in situ with high sensitivity and etch profiles ex situ
- Identify reaction products and measure product velocity distributions (movable mass spectrometer)
- Determine dynamic and kinetic parameters essential for modeling.

Availability: Currently in use at LLNL. Interested potential users may arrange to submit a test sample for measurement of etching and deposition parameters.

Contact

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